

CLAIMS

1. A haptic feedback controller for controlling a controlled appliance, comprising:

a base;

a cap that is rotatable with respect to the base;

a piezoelectric motor including a ring-shaped stator that is fixed to the base and a ring-shaped rotor that is fixed to the cap;

a rotation control device for controlling a rotational state of the piezoelectric motor; and

a rotational state detecting device for detecting the rotational state of the cap with respect to the base or the rotational state of the piezoelectric motor.

2. A haptic feedback controller according to Claim 1,

further comprising an input/output device that has a function for outputting rotational state information based on a detection result of the rotational state detecting device and a function for receiving an input of feedback information used for controlling the rotational state of the piezoelectric motor.

3. A haptic feedback controller according to either Claim 1 or Claim 2,

wherein a shock absorbing member is provided between the base and the stator and/or between the cap and the rotor.

4. A haptic feedback controller according to Claim 3,
wherein a ring-shaped sliding member is provided between the
stator and the rotor.

5. A haptic feedback controller according to any of Claim 1 to
Claim 4,

further comprising a mechanism for changing a distance between
the base and the cap in a direction in which pressure is applied.

6. A haptic feedback controller according to any of Claim 1 to
Claim 5,

wherein the base and the cap are integrated with a bearing
mechanism in between.

7. A haptic feedback controller according to any of Claim 1 to
Claim 6,

wherein the rotational state detecting device includes an
encoding barcode fixed to an inner surface of the cap and a sensor
unit fixed to an inner surface of the base, and by detecting movement
of the encoding barcode with the sensor unit, detects the rotational
state of the cap with respect to the base.

8. A haptic feedback controller according to any of Claim 1 to
Claim 6,

wherein the rotational state detecting device detects the

rotational state of the piezoelectric motor by analyzing a current flowing through the piezoelectric motor.

9. A haptic feedback controller according to any of Claim 1 to Claim 8,

wherein the haptic feedback controller is ring-shaped.

10. A haptic feedback controller according to Claim 9,
wherein the base and the cap are disposed so as to face one another with a predetermined gap between the respective outer circumferential parts thereof, and a plurality of contact switches disposed apart from one another in a circumferential direction are disposed on at least one of the outer circumferential parts.

11. A haptic feedback controller according to either Claim 9 or Claim 10,

wherein a plurality of contact switches disposed apart from one another in a circumferential direction are disposed on an inner circumferential surface of the haptic feedback controller.

12. A haptic feedback controller according to any of Claim 1 to Claim 11,

wherein a non-slip member is provided on a bottom surface of the base.

13. A haptic feedback controller according to any of Claim 1 to

Claim 12,

 further comprising a function for controlling the piezoelectric motor, when the user has rotated the cap, to maintain a rotated state.

14. A haptic feedback controller according to any of Claim 1 to

Claim 13,

 further comprising a function for controlling the piezoelectric motor, when the user has rotated the cap, so that the rotor moves in a direction away from the stator.

15. A haptic feedback controller according to any of Claim 1 to

Claim 14,

 further comprising a function for controlling the piezoelectric motor, when the user has caused a change in the rotational state of the cap, so that the rotational state after the change is maintained.

16. A haptic feedback controller according to any of Claim 1 to

Claim 15,

 further comprising a function that controls the piezoelectric motor to have various kinds of sound emitted, to have various kinds of vibration produced, and/or to have various kinds of resistance applied to the cap.

17. A haptic feedback controller according to any of Claim 1 to

Claim 16,

 further comprising a plurality of light sources disposed apart from one another in a circumferential direction.

18. A haptic feedback controller according to any of Claim 1 to Claim 17,

 wherein the input/output device includes an input/output interface that can obtain a power supply from the controlled appliance.

19. A haptic feedback controller according to any of Claim 1 to Claim 17,

 wherein the input/output device includes an input/output interface that can wirelessly exchange information with the controlled appliance.

20. A haptic feedback controller according to any of Claim 1 to Claim 19,

 wherein the rotation control device and the rotational state detecting device are disposed in a space formed between the base and the cap.

21. A haptic feedback controller according to any of Claim 1 to Claim 20,

 wherein the controlled appliance is one of a PC, a household electrical good, a game system, a toy, a content editing appliance,

a means of transport, a machine tool, and a medical tool.

22. A method of controlling a haptic feedback controller that controls a haptic feedback controller including a piezoelectric motor as a driving source for causing haptic feedback, the method comprising:

a step of controlling the piezoelectric motor, when the user has caused the piezoelectric motor to rotate, to maintain a rotated state thereof.

23. A method of controlling a haptic feedback controller that controls a haptic feedback controller including a piezoelectric motor as a driving source for causing haptic feedback, the method comprising:

a step of controlling the piezoelectric motor, when the user has caused the piezoelectric motor to rotate, so that a rotor of the piezoelectric motor moves away from a stator of the piezoelectric motor.

24. A method of controlling a haptic feedback controller according to either Claim 22 or Claim 23,

further comprising a step of controlling the piezoelectric motor, when the user has caused a change in a rotational state of the piezoelectric motor, to maintain the rotational state thereof after the change.

25. A method of transmitting messages using a haptic feedback controller, comprising: a step of controlling a motor for causing haptic feedback to have various kinds of sound emitted, to have various kinds of vibration produced, and/or to have various kinds of resistance applied to transmit a message relating to language information to the user.